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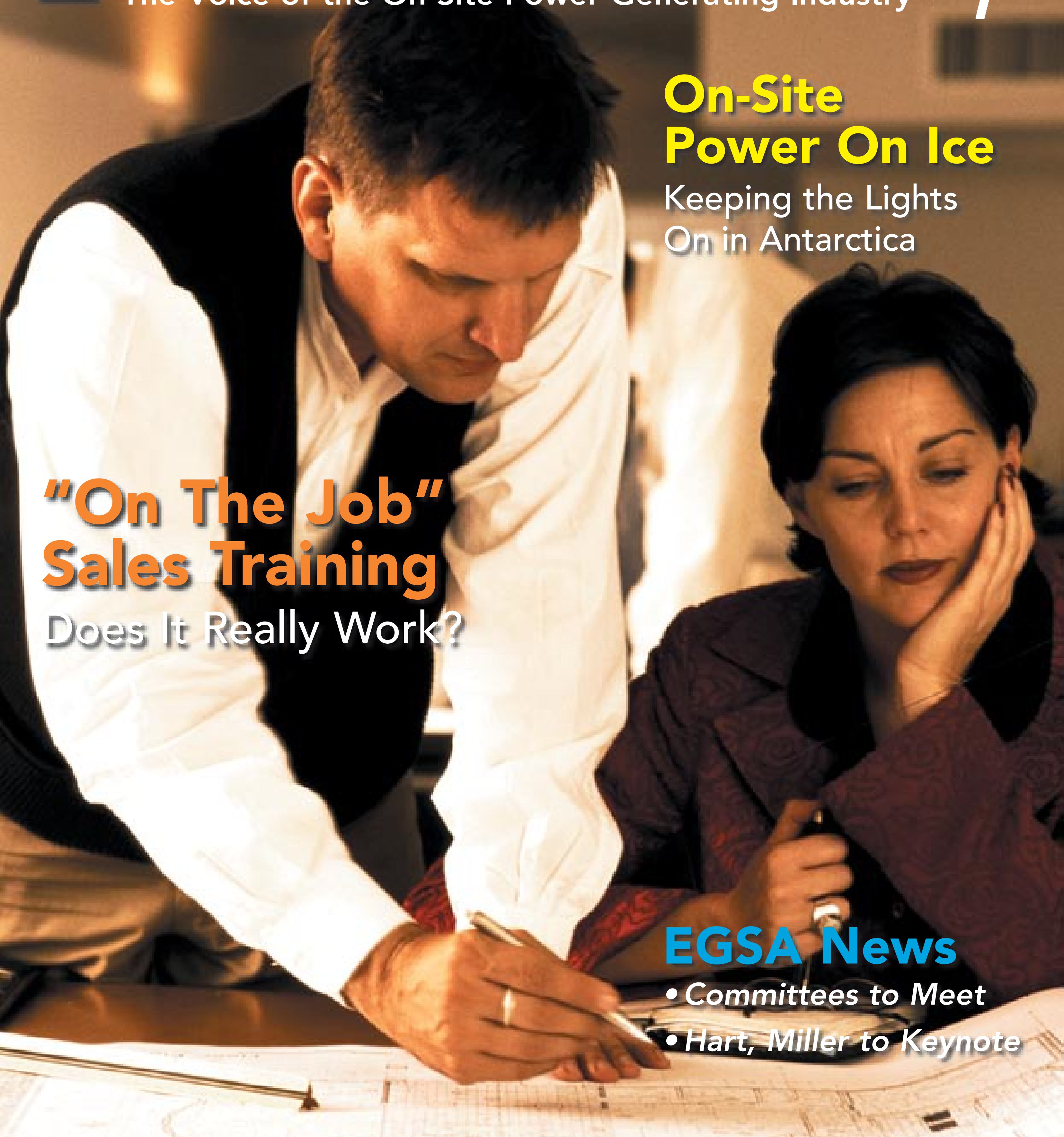

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- *Committees to Meet*
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CONTENTS

Volume 42, No. 2 • March/April 2007

Columns

From the Top 7
Data Centers: Opportunity and responsibility.

Education 8
Take my Committee, please.

Codes & Standards 10
NFPA and ISO news.

Features

Does "On the Job" Sales Training Work? 14
Sales guru Dave Kahle asks: Is "on-the-job" training the best way for a Distributor/Dealer to develop a salesperson?

On-Site Power on Ice 18
Matt Strine, an EGSA Certified Generator Technician and past David I. Coren Memorial Scholarship winner, writes about his recent job in Antarctica.

Dealing With Landfill Fuel 25
Evaluating fuel pretreatment options for landfill gas-to-energy projects.

Departments

Opportunities Calendar 5
Association and industry events.

Index of Advertisers 6
Who's who in this issue of *Powerline*.

EGSA News 12
The latest from EGSA.

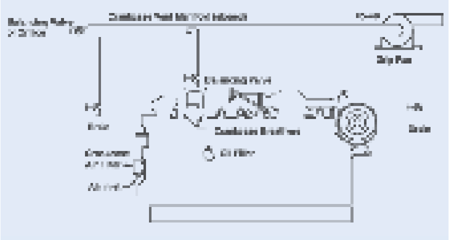
EGSA Membership Application 29
It pays to be a member of EGSA!

Job Bank 34
Looking for a new job?

Industry News. 37
The latest reports.

New EGSA Members 42
See who's just joined EGSA.

On the Cover: Does on-the-job sales training really work? Page 14.



Pretreating landfill fuels for gas-to-energy projects. Page 25.

Matt Strine writes about his once-in-a-lifetime opportunity to put his Generator Technician Certification to good use in Antarctica. Page 18.

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EVENTS CALENDAR

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The Association's Annual Convention of Members. Speakers will cover business and technical aspects of On-Site Power Generation and current industry trends. For additional information, visit *www.EGSA.org* or call (561) 750-5575.

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Schools

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December 11-13, 2007; New Orleans, LA

The world's biggest show for power generation, featuring the EGSA On-Site Power Pavilion. For exhibit information, contact EGSA at (561) 750-5575, ext. 205 or e-mail Jalane Kellough at *J.Kellough@EGSA.org.*

POWER-GEN Asia 2007

September 4-6, 2007; Bangkok, Thailand

Recently combined with China Power, this event is one of Asia's biggest power generation shows. For information, visit *www.powergenasia.com.*

Vietnam Electricity Expo 2007

December 5-7, 2007; Hanoi, Vietnam

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INDEX OF ADVERTISERS

ABB Inc.	4
Altorfer	35
Anna, Inc.	15
ASCO Power Technologies	44
Avtron Mfg.	15
Baldor	41
Basler	43
Chillicothe Metal Co., Inc.	37
ComAp LLC	34
ComRent International	16
Davidson Sales	17, 36
Diesel Gas & Turbine Publications	39
Enercon Engineering, Inc.	2
Flight Systems	20
GenTech	16
Gillette Mfg.	21
GTI Altronics	13
Gus Berthold Electric	5
JRS Custom Fabrication, Inc.	19
Kim Hotstart	24
Mid-America Engine	35
MTS Power Products	31
Murphy, FW	23
Power Search, Inc.	22
Pritchard Brown, LLC	21
Ring Power	42
Robinson Custom Enclosures	40
Russelectric, Inc.	9
Silex	34
United Rentals	40
Wabash Power Equipment Co.	37
Wexler CSD Ltd.	20

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Gary Kidwell
2007 EGSA President

Data Centers: Opportunity and Responsibility

Is it any wonder that the growth of data centers is taking on epic proportions? Managing—and especially losing—data can be a very expensive proposition; both dollars and productivity are at risk.

The statistics on the costs of downtime are sobering. Brokerage operations, for example, can lose as much as $8 million an hour when data centers go offline, according to the Data Centers Users Group.

The National Institute of Standards and Technology estimates that $15.8 billion is lost every year in time spent locating, verifying and recreating facility data.

Losing data, in fact, can impact an organization's very survival. The National Archives and Records Administration reports that 93 percent of companies that lost data for 10 days or more due to a disaster filed for bankruptcy within one year. Half of those businesses filed for bankruptcy immediately.

The Data Center Institute operated by AFCOM predicts that during the next five years, power failures and limits on power availability will stop data center operations at more than 90 percent of all companies. This is an incredible number and might reflect the lack of an adequate standby power system to keep the centers operating.

A survey of AFCOM members conducted by the Institute found that 20 percent said their data centers exceed 80 percent of their power capacity. Almost half of the data centers exceed their power capacity by 50 percent. Little wonder since power demands have soared to 150 to 200 watts per square foot, from 60 watts.

Besides the aversion to losing data, the demand to process and store ever larger volumes of it will continue driving demand for new, remodeled and co-location facilities. Nearly four of 10 AFCOM members either have built new centers or added to electrical capacity in the last five years or will need to add capacity in the next five years.

Other drivers include surging demand for wireless technology, music and video downloads, and Internet auctions and telephony. Disaster recovery preparedness and the need for more and more power and cooling capacity also are pushing demand. This last driver speaks to EGSA members. Satisfying this need demands engineered solutions and creates backlogs that extend to two or more years, rather than the weeks of only a few years ago.

In general, new centers will be constructed for hospitals, financial and educational institutions and smaller and smaller companies. Hospitals want to satisfy HIPPA (Health Insurance Portability and Accountability Act) and JCAHO (Joint Commission on Accreditation of Healthcare Organizations) requirements, digitize patient information and move toward virtual healthcare. In fact, hospitals have been called data centers with patients.

Financial institutions want to comply with Check 21 by digitizing all checks. Colleges and universities want to consolidate departmental IT systems and smaller companies are concerned about Sarbanes-Oxley and Security and Exchange Commission requirements, and the need for increased speed.

Considering that data centers can cost anywhere from $20-$200 million that equates to serious demand for electrical generating system products and services to help keep centers humming when utility power unavoidably fails.

The Power Play

Standby power, of course, is the linchpin between data centers and business-critical continuity. Providing continuous power and tolerating single or even multiple points of system failure requires redundant power systems and components, fuel systems, automatic transfer switches and UPSs.

Power systems for tier four data centers, the Rolls Royces of the data center world, typically require 10 or more engine-generators of two megawatt capacity or higher. Add the 15kV paralleling and main switchgear, multiple redundant controls and multiple redundant battery systems needed to complete a standby power system, and you have significant business for our industry.

And as large as they now are, these power systems will continue to be upsized. Data center power consumption has been tripling every year and should continue. It's already reached the point where infrastructure costs exceed hardware costs, a turnabout if there ever was one.

Cost/Benefit Responsibility

This opportunity carries responsibility, however. We are charged with helping data center designers, owners and managers make informed decisions about the type of standby power systems they select.

Continued on page 12

Dennis Roundtree
Chairman, EGSA
Education Committee

Take My Committee, Please

I have just returned home from a meeting of the Reference Book Subcommittee. Under the able leadership of Steve Stoyanac, we are planning the fifth edition of the On-Site Power Reference Book. This was my first function as the new Chairman of the Education Committee. I find that rewriting the reference book is a lot like giving birth, except nobody offers you a painkiller.

This is just one of several projects launched by my predecessor, Michael Pope. We are also overhauling the EGSA On-Site Power Generation School—already one of the best educational programs in the industry. Next year we plan to launch a two-tier school with Beginning and Advanced Sessions designed to meet the widely varying needs and experience of our students. That subcommittee is headed by Herb Daugherty, who is also on the book subcommittee, teaches at the school and does just about everything else we talk him into doing. Herb has an odd idea of "retired," for which we are very thankful.

Many others have given years of service to the Education Committee in various positions, and we also have a legion of instructors, book authors and others. All of these individuals work without pay, reward or sufficient recognition.

I can also enthusiastically praise the Technician Certification Program: (1) because it is an innovative, ambitious and badly-needed program; and (2) because I had nothing to do with creating it. It took a small army of good people to put this program together and they deserve our thanks.

Last but certainly not least, there is EGSA Director of Education George Rowley. Our semi-official committee motto is "Let George Do It." If you haven't met him yet, George is the distinguished, professorial-looking gentlemen seen leaving every EGSA conference with his to-do list in a wheelbarrow.

Supervising all this dedication and talent is an intimidating task for a semi-organized peddler from the heart of the Rockies. I am not afraid, however, to call for help. Fortunately, all of the aforementioned and un-aforementioned people who have been part of this effort in the past are continuing to pitch in, but we always have room for more. The EGSA membership is a diverse cross-section of the most talented people in the industry, and it will take more of them to keep our educational initiatives fresh and engaging. After all, there is so much left to do: things like online education, multi-lingual programs and more.

So, please, volunteer your time and energy. We need book authors, instructors, and we can always use more committee participation at the conferences. Yes, it's inviting to spend that Monday afternoon by the pool, warming up for the golf tournament or holed up in your room answering email. However, if you really want get the most from your EGSA membership, you have to participate. There isn't a better way to get to know people and contribute to the industry that keeps us all in steady paychecks than to get involved in the committee process, whether it's the Education Committee or any of the other worthy committees.

It is my hope that you are registered to attend the convention in Savannah. If not, please attend the Fall Conference. Meet your colleagues, and find a Committee Meeting that peaks your interest. Raise your hand. Speak your peace. Listen, learn and share. At the very worst, we will have spared you a nasty sunburn or slowed the onset of carpal tunnel syndrome.

Personally, I hope that the door you walk through is the one with the nervous rookie at the head of the table. He needs all the help he can get. ■

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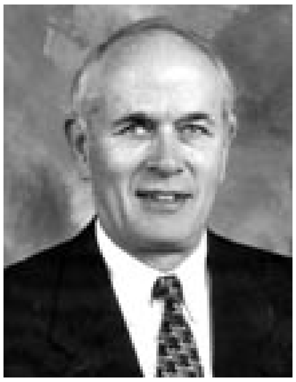

Herb Whittall
EGSA Technical Advisor

NFPA and ISO News

The International Standards Organization (ISO) recently issued a report on the DIS voting of ISO/DIS 3046-4: Reciprocating internal Combustion engines–Performance–Part 4: Speed governing. The vote was seven (7) countries in favor and one against. The U.S. and China abstained. Of the seven votes in favor, three came with some very revealing comments; there were 61 member comments in all. Most were due to errors in writing and/or editing the document, incomplete or missing definitions, and incorrect or incomplete references to obsolete documents and formulas. In this case, the items commented on will be corrected before the standard is issued as a new edition. However, this instance illustrates just how few people are really involved in writing the standards that affect us all.

The same is true of legislation and the rules that it generates. A few issues back I talked about the EPA-proposed regulation concerning generator sets where the engine manufacturer and the customer are mentioned, but the generator set assembler was completely ignored. Why? Because the writer of the rule forgot that generator sets may be assembled by someone other than the engine manufacturer. This omission was pointed out to the EPA during the comment period by EGSA and other manufacturers who keep an eye on what the government is doing. Considering all the pages that Congress publishes in the Federal Register every day, keeping up is quite a job.

The ISO has published ISO 8178-1:2006–Reciprocating internal combustion engines–Exhaust emission measurement–Part 1: Test-bed measurement of gaseous and particulate emissions.

ISO/DIS 8178–5–Reciprocating internal combustion engines–Exhaust emission measurement–Part 5: Test fuels is in the comment period until March 15. The only comments from the various countries were that some of the fuel test specifications were not to the latest IEC standards.

Last fall, the NFPA decided to reorganize NFPA 99 – *Health Care Facilities* into new sections and requested all current committee members to reapply for positions on the new committees. The committee that Herb Daugherty and I serve on as primary and alternate, respectively, was not being changed but we were still required to reapply. The latest *NFPA News* indicates they are looking for members for lots of the committees for NFPA 99 including the overseer—the technical correlating committee. I think NFPA made a big mistake in reorganizing and requiring all current members to reapply. Especially since all the NFPA codes were redone in a new format only two code cycles ago.

In the same *NFPA News* the Committee on Internal Combustion Engines for NFPA 37 – *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines* is looking for members in the interest categories of Enforcer and User. I wonder who qualifies as an enforcer? EGSA members may be users and want to apply.

The Joint Commission on Accreditation of Healthcare Organizations has issued a Sentinel Event Alert titled "Preventing adverse events caused by emergency electrical power systems failures." The Alert refers to failures of emergency standby power systems that did not come on line as needed in recent blackouts, floods and hurricanes. The Alert goes on to remind end-users that "meeting NFPA codes and standards (is) only a start." Following Hurricane Katrina, many hospitals and other installations could not get their diesel fuel tanks replenished and they ran out of fuel and, as a result, power. Also, emergency systems did not power elevators that were needed for evacuation following the hurricane. If the joint commission's recommendations are adopted, hospitals in hurricane-prone areas are likely to need more standby power. EGSA members need to be prepared to write more business. ■

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2007 Media Kit for *Powerline* Magazine Available Online

The Electrical Generating Systems Association (EGSA) has announced that the 2007 Media Kit for its bi-monthly publication, *Powerline* magazine, is available for download at *www.EGSA.org*.

As a service to its members and the industry, the Electrical Generating Systems Association (EGSA) publishes *Powerline*—the ONLY magazine that thoroughly and exclusively covers On-Site Power electrical generation and its related industries throughout the globe.

No other publication can match *Powerline* for its focus on On-Site Power with a circulation that includes Manufacturers, Distributor/Dealers, Manufacturer's Representatives, Consulting and Specifying Engineers, Service Firms, End-Users and others throughout the U.S. and around the world who make, sell, distribute, and use generators, engines, switchgear, controls, voltage regulators, governors, and more.

Each issue of *Powerline* includes important business articles covering an array of diverse industry issues, such as international markets, contracts, financing, trade agreements, and much more. Technical and "how-to" articles educate readers about new technology trends and commonly misunderstood applications. In addition, regular columns on industry codes and standards, news from Europe, manufacturer's representative issues, industry events and more keep readers informed.

The On-Site Power Generation Industry continues to be one of the most vibrant and active sectors within the nation's energy marketplace. With products ranging from diesel gen-sets to hydrogen fuel cells and applications ranging from emergency back-up to cogeneration, On-Site Power is at the forefront of today's fast-moving marketplace.

According to EGSA statistics*, the industry is experiencing a period of growth. Participating EGSA members report that shipments of small generators (10-250kW) were up 37.9% in 2005 over the previous year. Shipments of large generators (250-4000kW) were also up 21.5%. In the first six months of 2006, shipments of small generators were up 47.5% over 2005, and shipments of large generators were up 21.5%. Most industry observers agree that the market will continue to grow beyond 2006.

To download a copy of the 2007 Media Kit or to download information on submitting editorial features for publication, please visit www.EGSA.org.

**The EGSA Quarterly Generator Shipment Survey presents composite reported shipments of PTO and non-PTO generator sets in North America using data submitted by participating EGSA-member companies. As such, it only represents a portion of the overall marketplace.*

EGSA Committees and Council to Meet at Spring Convention

All EGSA Committees and the Distributor/Dealer Council will meet during the 2007 EGSA Annual Spring Convention in Savannah, GA on March 19. Committee Agendas are available on the EGSA web site at *www.EGSA.org*. The Minutes for each Committee and Council Meeting will be posted to the web site in the coming weeks. ■

From the Top

Continued from page 7

It's a critical decision with far-reaching consequences. A quarter of all data centers in the next five years will suffer a business disruption serious enough to affect the company's ability to continue business as usual, according to industry predictions.

Let's help minimize those potential disruptions by helping data center customers compare standby power system designs to the degree of availability they require of their data center operations.

A center that needs to be available 99.9 percent of the time requires a totally different standby system than a center that must be available 99.999999 percent of the time. The difference in downtime varies by about eight hours. In terms of cost, it's hundreds of thousands of dollars and, in some cases, millions per hour.

Balancing cost and benefit will let customers know what they can expect from their standby systems.

On a personal note, I'm pleased to represent EGSA this coming year, again, and look forward to a productive term. Thank you. ■

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Is "On The Job" Training the Best Way to Develop a Salesperson?

By Dave Kahle

In our surveys, distributor CEOs indicate "on the job" training as the predominant method of developing salespeople. If everyone is doing it, it must be OK, right?

I don't think so. See if this sounds familiar: You are ready to expand your sales force, so you hire a nice guy who has some experience in the industry. You start him with a few days in the warehouse, have him sit in customer service for a week, and meet with whichever manufacturer's rep happens to stroll in. You send him out with a senior salesperson for a week or so. Then, he's deemed ready to represent you, and he's unleashed into the territory with the charge to "go forth and sell a lot." He'll pick it up, you assure yourself, by learning "on the job."

Or, worse yet, you make it a practice of only hiring people who have experience, limiting your future salespeople to those who have gone through the process described above at some other company.

What's wrong with this tried and true method of developing salespeople? There was a time, 10 or 20 years ago, when competition was not nearly as fierce, where the job was not nearly as demanding, and salespeople not nearly as challenged as they are today, when this method was adequate. In today's hyper-competitive marketplace, however, "on the job" learning for salespeople consistently produces mediocre performers.

It's not that "on the job" training isn't effective for other positions. "On the job" learning works well for other positions, like customer service, warehouse, etc., where there is both a mentor constantly present as well as a clearly defined articulation of how to do the job well.

However, for salespeople, it's an abdication of responsibility. There is rarely a mentor constantly available, nor is there, in most businesses, a clearly defined set of practices as to what constitutes the best way to do the job. "On the job" training, for salespeople, is code for "learn on your own." Let's examine why that is.

"On the job" training for salespeople assumes that there are no standards for what constitutes a good salesperson. Other than net sales and/or gross profits measured at the end of the month, there are no standards for what constitutes professional excellence. Therefore, every salesperson is left to develop his own "style." If there were a set of best practices that define the way a professional salesperson does his job, it would be unreasonable to expect that every salesperson would, by trial and error, stumble across those best practices. That's the concept.

Of course, the problem is that this idea is the biggest single cause of sales mediocrity in existence today. It is totally, completely false.

There is a set of behaviors that constitute the skill set of the sales masters. The job of the salesperson has been studied and written about probably more than any other profession in the world. There exists a universal body of knowledge about how a good salesperson does his job. There are behaviors and competencies that relate to planning, preparation, time management, interaction with customers, etc. Regardless of the hype of promoters, there are no secrets in selling.

I just encountered a well-trained, professional salesperson. He answered the phone when I inquired with a company with whom we already have a relationship. I was interested in expanding the relationship to include some other services from this company.

He was polite and respectful. He first referenced our previous relationship, and then asked a series of questions that had obviously been prepared beforehand. I could hear him typing the answers into the computer. He repeated back to me, several times, his understanding of exactly what I was looking for, and exactly what my situation and requirements were. He then outlined a series of next steps, the most next logical being him doing some research on a solution, and then calling me back to relay that solution.

We agreed, and made an appointment for that phone call. When the time came, he was prompt. He began the phone call by reciting the steps we had taken, and once again, explained his understanding of my situation. When I agreed that he accurately understood our situation, he relayed his proposal. We discussed it, and together settled on a next step to move the project forward.

After the call, I felt very comfortable, knowing the project was in the hands of a well-trained professional salesperson. He exhibited mastery of a series of behaviors that we teach every salesperson. In other words, he knew how to sell.

He was so good, that I doubt that he stumbled over these best practices on his own. It didn't matter if he was black, white, yellow, green or orange; it didn't matter if the person was male or female; Indian, Puerto Rican, or American; it didn't matter if he was old or young. It didn't matter what the product was or how long the company had been in business. What did matter was that he was a well-trained, professional salesperson, exhibiting all the behaviors of a master salesperson.

I suspect that he was intentionally exposed to these best practices, that he was trained in them, that he practiced them until he achieved some degree of competence and that he was and is regularly inspected to make sure that he continues to develop his competence with these behaviors. I doubt if he was expected to "learn on his own."

My point is this: There is a universal body of knowledge about how an effective professional salesperson does his job. This set of practices can be identified, learned and managed in every salesperson.

To not do that is to promote the concept that every salesperson has "his own style," and can't therefore, be held accountable for anything.

"On the job" training for salespeople usually means that we expect the salesperson to eventually "get it," but we have no articulate idea of what "it" is.

"On the job/on your own" assumes that every salesperson will be motivated to eventually figure out how to perform well. They will strive, the thinking goes, to continue to modify their behavior until they arrive, by trial and error, at their peak level of performance.

Ah, if only this were true we could all sleep better at night. The problem is, of course, that very few salespeople are internally motivated to continually improve their performance. My experience has led me to believe that only about five percent of salespeople, or one out of twenty, invest in developing their own skills. Specifically, only one of 20 salespeople has spent $25 of his own money on his own development in the last 12 months.

That means that the vast majority, 95 percent, really aren't interested in putting any of their own time or money into their own growth and development.

Hence, the idea underlying the concept of "on your own" training is—for 95 percent of the sales force—false.

Then there is the fact that salespeople are notoriously self-delusional. Ask a salesperson how it's going, and note how many times you get anything other than "great!" Regardless of the reality of the situation, salespeople often delude themselves to think that things are only getting better.

There is a very necessary personality trait in a field salesperson that constantly assesses each situation in terms of its potential. In other words, they look at an account, and see it for what it could become, not necessarily acknowledging all the obstacles to getting it there. This is a necessary and beneficial trait for salespeople when it drives their behavior. Unfortunately, it is also the cause of self-delusionment when it comes to changing their own behavior. Make a call with a salesperson and ask him how it went, and he'll pick out the one or two positives and expand on them, while at the same time leaving out the mistakes and lack of competence they showed.

It's for this reason that most salespeople don't know what they do that produces sales. A few years ago, Systema Corp. examined this issue. They observed 1,700 salespeople in 22 different industries. They asked the top performers to describe what

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they did on a call to get results. Then they sent trained observers into the field to watch their behavior. The results? There was no relationship between what they said they did and what they actually did. In other words, even good salespeople couldn't recognize what they did to get results.

It's also for this reason that they don't have an accurate assessment of how competent they really are. Another study discovered that few salespeople have an accurate opinion of their own abilities. When asked about the function of asking good questions, 87 percent of the 300 salespeople studied indicated that they knew that was an important part of the sales process. Yet, when they were observed, only 27 percent actually exhibited the ability to ask good questions. So, roughly three out of four salespeople are clueless as to the extent of their own abilities. They think they are far better than they really are!

The bottom line is this. Salespeople generally don't know what they do that brings them sales, and they think far more highly of their own abilities than they should.

Add all this up, and it's clear that "on the job training for salespeople" is really doublespeak for "no training for salespeople."

It's clear that "on the job training," for salespeople at least, is a vestige of days gone by, and just doesn't work. Let's relegate "on the job training for salespeople" to the same dust bin into which we deposited such legacy systems as paper inventory cards, electric typewriters, and 8-track tape recorders. Let's address the issue of developing effective salespeople with a systematic approach to teaching the best practices of the professional salesperson. Let's give them a chance to succeed and excel.

About Dave Kahle

Dave Kahle is a consultant and trainer who helps his clients increase their sales and improve their sales productivity. Dave has trained thousands of salespeople to be more successful in the Information Age economy. He is the author of over 500 articles, a monthly e-zine, and six books. Ten Secrets of Time Management for Salespeople was recently released by Career Press. You can join Dave's "Thinking About Sales Ezine" on-line at http://www.davekahle.com/mailinglist.htm.

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Coren Scholarship Winner Update

On-Site Power on Ice

Keeping the Lights On in Antarctica

By Matt Strine

Editor's note: Powerline readers and EGSA members may recall that Matt Strine is one of the first individuals to have been awarded a scholarship under the David I. Coren Memorial Scholarship Program as a student at Penn College. Matt is also an EGSA Certified Electrical Generating Systems Technician.

Matt recently traveled to McMurdo Sound in Antarctica where he spent the 2006-2007 austral summer as a power plant mechanic for Raytheon Polar Services Company, a contractor supporting the National Science Foundation's work on the ice.

This weblog is reprinted with express permission of Penn College. All photos are provided courtesy of Matt Strine.

Above: Matt stands next to one of the Deltas. "Those are 66-inch tall tires and a lot of people complain they get stuck easily," says Matt. "I haven't been able to get them stuck yet so that tells me some people just can't drive in the snow."

When I stepped off the Air Force C-17 August 20th, 2006 and the inside of my nose started to freeze, a thousand thoughts went through my head. I can remember thinking how miserably cold 40 below zero was already and what on earth I had gotten myself into. It was barely light out even though it was noon and the wind was blowing the snow, making my entire surroundings a white haze. My first experiences on the seventh continent were a little overwhelming, yet I had trouble containing my excitement thinking I'd be spending the next six months here. I had learned about this job opportunity over two years before and it was satisfying to know I had followed through and made it happen. I assured myself it was the right decision and that the next several months would leave me with memories that I'd surely have for life.

In April of 2004, I was only weeks away from graduating with a degree in Electric Power Generation Technology from Penn College and already had a job lined up for my introduction to the real world. I sat with a friend and fellow EPG student, Joe Duskasky*, one afternoon and got onto an interesting subject. Joe had been surfing the net and had stumbled onto a guy who did power generation work in Antarctica. As Joe passed on the details of what this guy did there, I was excited to hear about a job opportunity in a place few ever get to see. Joe shared his email address with me and later that day I sent one off asking more information about the job.

A few days later I heard back from him and found out they were looking for a diesel mechanic to work in the power plant of the main U.S. science research station, McMurdo. He explained the type of work and that the normal contracts were six months, running from mid-August to mid-February, during the Antarctic summer. He asked if I was interested, which I certainly was, and if I wanted the job for the coming season. While as promising and exciting as the offer was, I had to accept that now was probably not the best time. After graduation, I had a two-year obligation to Cleveland Brothers Caterpillar for financial assistance during school and it was important to me to honor the commitment. I explained my situation to him and told him I would certainly keep in touch.

Over the next two years I did just that and in return, he sent me pictures and stories from the ice which only made me more dead-set on going there. My commitment was to end in June of 2006, so in February of that year, I started the process that would lead me to Antarctica. For the next

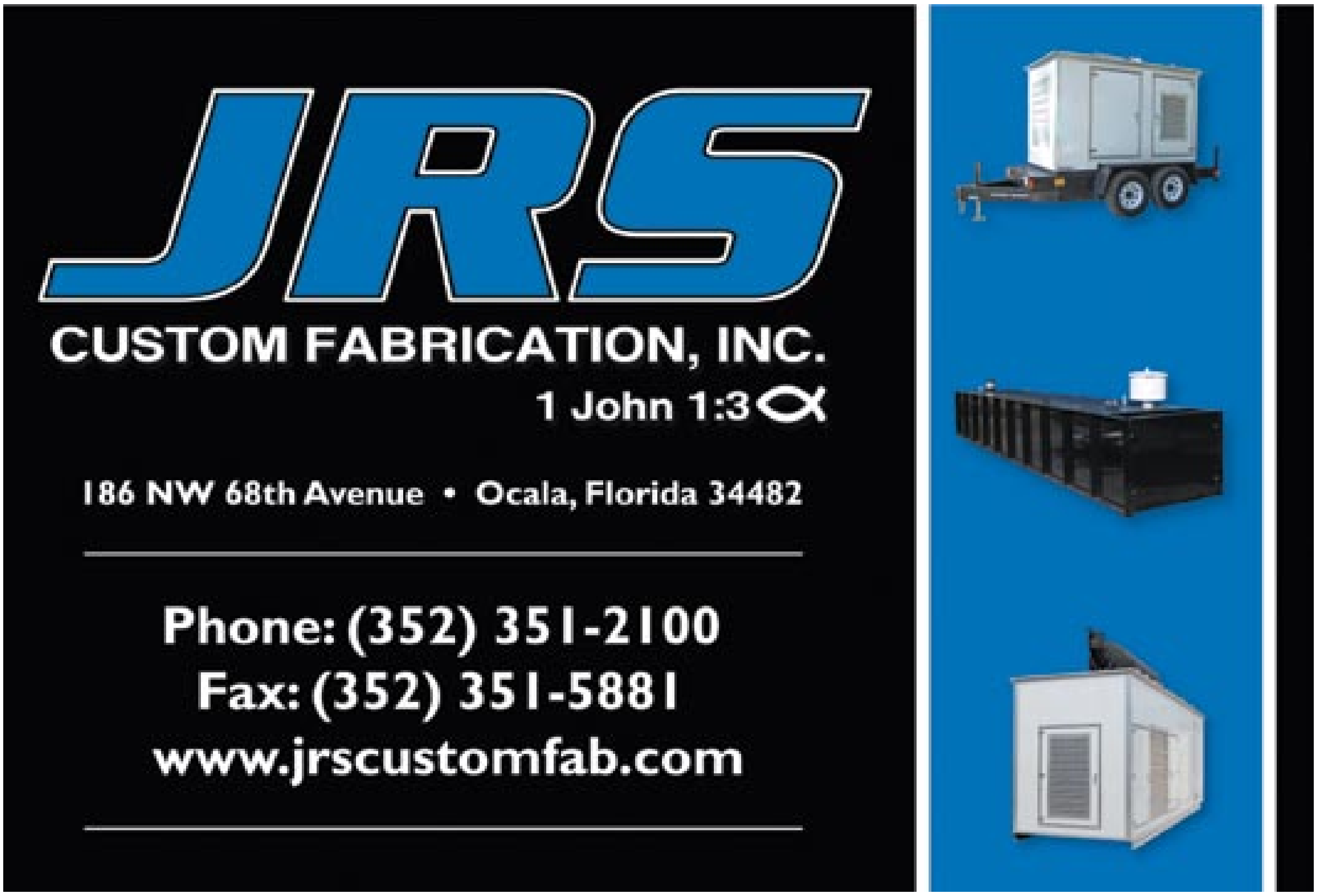
**Joe Duskasky is also a past Coren Scholarship winner and an EGSA Certified Generator Technician.*

few months, I went through applications, interviews, and medical tests and then finally in April, was offered the job of power plant mechanic for the 2006-2007 austral summer. I would be working for Raytheon Polar Services Company who is contracted by the National Science Foundation to support scientific research.

I left my home in York, PA on the 14th of August and headed to Denver, CO for a few days of orientation and training. There I met my fellow workers and learned more about what I could expect things to be like. I and 200 others left Denver headed for Christchurch, New Zealand with stopovers in Los Angeles and Auckland, New Zealand. After almost an entire day on a plane, we landed in Christchurch where we would board an Air Force C-17 for the final leg of the journey. Fortunately though, we had two days to spend in Christchurch before heading to the ice. I spent the rest of the first day wandering around the city taking in everything I could. This was only my second time out of the country, the first being England, and I noticed striking similarities between the two. The next day we all reported to the Antarctic Operations Center to get issued our extreme cold weather clothing or ECW. After getting more warm clothes than I thought could ever fit on one person, we were free until the next morning when our C-17 flight would leave.

On the morning of August 20th, we checked out of our hotels and took taxis back to the airport for our flight. The flight was scheduled for a 6:00 A.M. takeoff which would put us on the ice around noon. Down on the ice it was just the tail end of winter which meant only about four hours of twilight a day. The idea was to get the plane down there and back out during the short amount of useable light. We wouldn't see the sun itself for another few weeks. The C-17 is a massive plane that seats 200 people plus cargo fairly comfortably. The only drawback is the handful of small windows out of which one may look. The pilot announced that the weather on the ice was good enough to land, which everyone was happy to hear after five hours in the air. It is not uncommon to get "boomeranged" and have to turn around and head back toward Christchurch due to poor weather. We made it in on the first

Above: Matt Strine stands in front of the Mount Erebus volcano which, points out Matt, "can be seen smoking at the top."



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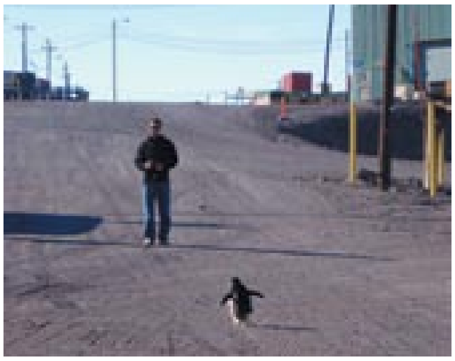
shot and landed on a glacier runway made of super compacted snow.

I spent the next few weeks getting to know the power plant and followed the "winter over" mechanic around learning all I could. We ran six Caterpillar D399 generator sets that were made in 1978. Each engine has over 100,000 hours on it so they're getting tired, but still run strong due to good maintenance. A new power plant is being built with Caterpillar 3516B's but won't be operational for another year. Our tasking for this season was to include a major overhaul of one of the engines which would probably be the last major overhaul before the plant was decommissioned.

The rest of August and all of September were spent settling into life on the ice. We worked six days a week, ten hours a day which limited free time a bit. There were only about 500 people on station at this time, so it felt like a cozy little community. Every day it gradually got more and more light out, but the temperatures still were always well below zero. Most of my time was spent in the nice warm power plant, but I routinely got to go and work on generators out at the runway and in other parts of town. I got to attend "Happy Camper" school which is an overnight survival course to prepare you for having to spend an unexpected night out.



A lone Adelie pengiun takes to the street to check out the sights of McMurdo Sound.

During the first two months here I continually got asked two things from friends back home: had I seen any penguins yet and what was there to do when I wasn't working? The first question was always the same answer: no. There were penguins around, but they were all miles from station at that time of the year. I could answer the second question a little better since there were a few things to do here other than work. There are two bars on station, a smoking bar and a non-smoking bar as well as a coffee house where wine is served. A recreation department plans parties and outing events. A series of hiking trails snakes around the area, some offering fabulous views. There is a gym and equipment to work out on as well as a two lane bowling alley. The bowling alley was built in 1961 by the Navy and features old style pin-setting machines. A person is needed for each lane to pick up the fallen pins and lay them in the rack. A pull on a lever drops the rack down and resets the pins. For a few dollars an hour, you can join the ranks of years of pinsetters that've made bowling at the world's southernmost bowling alley possible. There are also trips out of town to go and visit the historic huts built in the early 1900's by explorers like Robert Falcon Scott, the second man to reach the South Pole. These huts were neat to visit since they were very close to what they had looked like in their day, as the

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low humidity and cold preserves them.

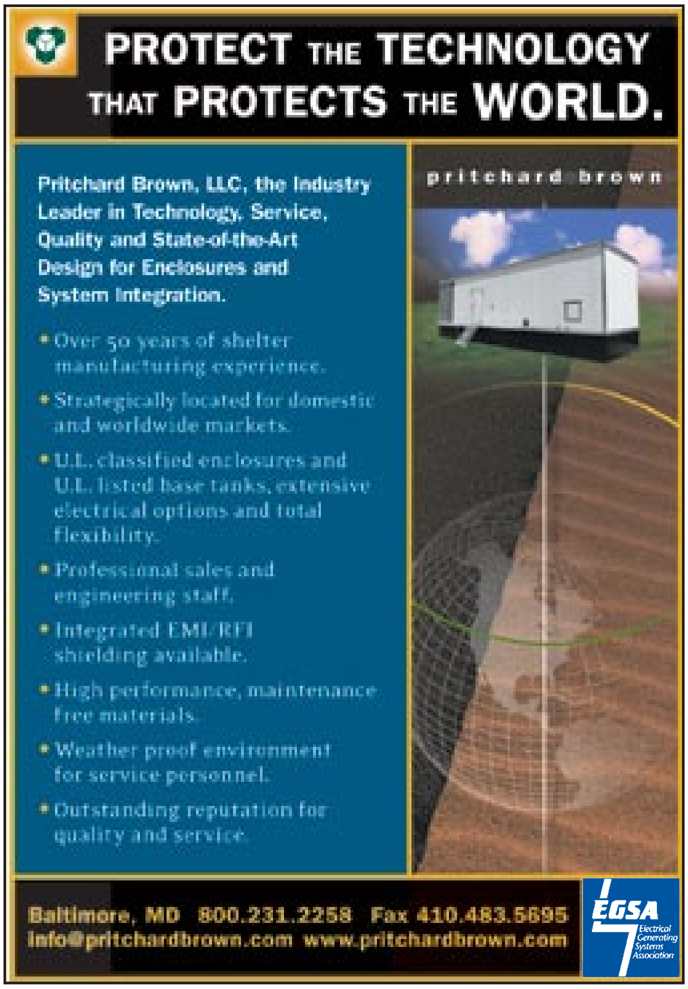
It didn't take long to see how important tradespeople were to making a facility like this run. I was always appreciative of the work that the janitors and dishwashers did, and was surprised to find out that they are some of the most competitive jobs. These jobs required the least amount of skills which meant the most number of people applied for them. That's not to say the skilled jobs aren't ever competitive, but I've heard numerous times that skilled workers are always the hardest to get. Knowing this, I am happy having the skills and experience I possess as it has helped me land a great job in one of the most incredible places in the world. Our power plant here is staffed by four operators, an electrician and a mechanic. As the mechanic, I'm responsible for keeping the six generators here running as well as looking after the seven stand-by generators around town. Most of the generators predate me, so there was a bit of a learning curve to pick out the quirks of the old iron.

When October came, it was the official start to summer and with it came an increased tempo around town. By mid-October, 700 more people had come to town and with them came longer lines for food in the galley. The sun was shining 24 hours a day by this time which took some getting used to. For the first few weeks of continual daylight, sleeping was a chore every night. My body always associated darkness with sleep and without the change from light to dark; it wanted to stay up all the time. I gradually got used to this, but still couldn't wait to see the night sky again.

> The skills and experience I possess…helped me land a great job in one of the most incredible places in the world.

The changes that brought summer weren't all bad, especially the warmer temperatures and wildlife. We had days that got into the upper 40's which is a night and day difference after feeling -40°F for weeks. In November, Skua birds began arriving and making their presence known around town. Skuas are a type of seabird that is bigger than a seagull and a lot more daring. It was common knowledge not to walk around outside with food from the galley since the Skuas felt no guilt at knocking your sandwich out of your hand and flying off with it. While I never suffered a Skua attack, I watched several others' meals get ruined. The warmer temperatures began to thaw the annual sea ice in places which brought seals and penguins closer to station. It was common to see Weddell seals lounging out on the ice in the same position for what seemed like days. Groups of Adelie penguins also came to visit and were a treat to watch. The Adelies are small penguins and waddle around with their wings out for balance, looking like toddlers when they move. Their mobility and curiosity means they sometimes go where they shouldn't, like on the roads here in town where they must dodge heavy equipment.

One of the goals I had when I got here was to try, somehow, to get to the South Pole. The U.S. runs a station there and regularly flies LC-130 Hercules in the summer to refuel and resupply the station. The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Matt with engine #4 in mid-teardown.

more I asked about it, the more apparent it became that getting to the Pole, unless for official business, was tough to do. There is the occasional boondoggle there for a day, but they were getting fewer each year. One day out of the blue we got a call saying the power plant at the Pole was having some serious issues and was in need of some parts and extra help. A day later I was on a flight south to help get the plant back in working order. The Pole is about 800 miles from McMurdo and physically sits at just over 9,000 feet above sea level. Changes in barometric pressure make it feel like it is over 10,000 feet. I spent the first few days at the Pole getting acclimated, as serious medical conditions can arise if you're not mindful. Easy tasks like tying my boots left me gasping for breath until my lungs got used to the thin air. The Pole rarely gets above 0°F and when I was there in the middle of summer, the highs only got into the -30°F range. We got the power plant squared away and I was able to get my hero shot at the geographical South Pole. The South Pole sits on an ice sheet a few miles thick that moves about ten meters per year, so every New Year's Day, the marker is moved to the new Pole. Standing at the complete bottom of the earth had to be one of the biggest highlights from my time here.

As I write this, the end of the austral summer is near and the station is again buzzing with activity in preparation for winter. Two ice breakers, the Swedish *Oden* and the Coast Guard *Polar Sea*, have made a 14-mile long channel in the sea ice to allow the resupply ship and fuel tanker to dock and unload their cargo. After they drop the next year's worth of supplies and fuel, they will leave with all the waste generated here for processing back in the states. Scientists and contract employees will begin redeploying in February, leaving only the "winter over" folks who will stay the long, dark winter until next August. Less than 200 people stay here at McMurdo for the winter and only about 60 stay at the South Pole, and they won't get to leave until November. There is no way out during the dead of winter, and it is said to be easier to get someone off the space station than out of the South Pole in the middle of winter.

With my contract nearly up, I'm planning my travels through New Zealand and Australia, ending up back in Pennsylvania sometime in early April. My time down here has been truly phenomenal and I will certainly remember it for years. I have my education and skills to thank for much of what I got to accomplish and see and if it had not been for them, I may never have gotten to stand at the bottom of the earth. ■

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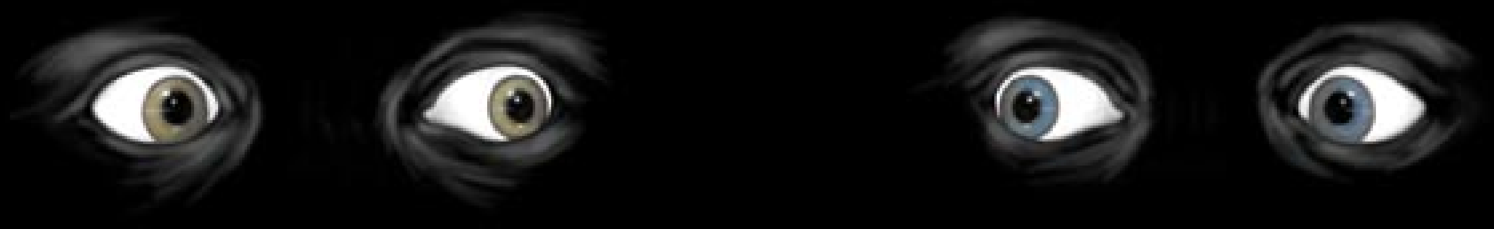

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Dealing With Landfill Fuel: Evaluating Fuel Treatment Options

By Michael A. Devine, Electric Power Group, Caterpillar Inc.

Dealing with fuel contaminants in landfill gas-to-energy systems is essentially a matter of economics: weighing the costs of removal against the benefits of improved service intervals, performance and reliability. This paper highlights the most common contaminants found in landfill gas and describes the effect they have on engine component life, the cost of power generation, and engine emissions and emission control techniques.

Users have options when dealing with landfill gas contaminants. These range from dealing with contaminants before they get to the generating equipment to selecting engines designed to operate with the contaminants. The external control option requires installation of equipment to reduce fuel contaminants, in exchange for higher ancillary equipment capital and maintenance costs. The internal engine control option involves engine manufacturers' design innovations in component metallurgy and other techniques that limit acid formation and keep engines operating safely.

The most favorable approach for a given application depends on factors such as gas composition, local emissions requirements, local power market conditions, and the site owner's performance and reliability expectations. Case studies at North American landfills illustrate extensive field experience with engines using internal modifications to limit the effects of corrosive fuel contaminants.

When challenged with the fuel contaminants in landfill gas-to-energy projects, there are two fundamental approaches: pretreat the fuel for improved service intervals, or operate an engine that is designed to minimize the impact of contaminated fuels and accept an increase in maintenance. Either way, it all depends on the economics of the project.

Introduction

There are two basic approaches for dealing with fuel contaminants in landfill gas-to-energy projects. The first is to pretreat the landfill methane, taking out many of the contaminants to produce fuel that meets the engines' operating requirements. The second is to forego all but the simplest pretreatment and install engines specially modified to burn impure fuel, yet still deliver acceptable component life and maintenance intervals.

Neither choice is universally better than the other. The most favorable approach for a given application depends on various factors: gas composition, emissions limits at the site, local power market conditions, and the site owner's performance and reliability expectations. In the end, the choice typically comes down to economics. The winning approach is the one that delivers, all things considered, the lower cost per kWh.

While fuel pretreatment has a longer history and more name recognition in the landfill gas-to-energy market, engine designs that deal with fuel contaminants internally have a 20-year track record of effectiveness. Those designs have improved steadily and are available on even the most technologically advanced, high-efficiency gas engines on the market. Therefore, any landfill gas-to-energy project developer can benefit from analyzing and comparing both approaches in light of site-specific conditions.

Landfill Fuel Contaminants

For users considering gas engines for power generation, fuel quality has been a key concern since the dawn of the landfill gas-to-energy industry. Landfill fuel contaminants, if not dealt with, will cause a wide range of engine problems. Contaminants of greatest concern are:

Sulfur compounds. During the combustion cycle, sulfur compounds—notably hydrogen sulfide (H_2S)—break down and combine with available water (the primary compound created in the combustion process) to form a weak sulfuric acid. If left unattended, this acid can severely damage aftercooler cores, bearings and any copper-containing engine components.

Halides. When halogenated hydrocarbons (chlorofluorocarbons, or CFCs) are oxidized in engine combustion, they release chlorine and fluorine, which in turn unite with water from the combustion process to form hydrochloric (HCl) and hydrofluoric (HF) acids. These acids, if not taken care of properly, will attack piston rings, cylinder liners, exhaust valve stems, valve guides and other critical wear parts.

Water vapor. Water vapor is not considered to be harmful when entrained as a vapor in the fuel at quantities below the point of saturation. (In fact, about 10 percent of the engine exhaust is water vapor.) However, water vapor in the fuel can combine with organic compounds common in landfill fuels during the combustion process to form organic acids like sulfuric, hydrochloric or hydrofluoric acid. Even the carbon dioxide (CO_2) can combine with water to form carbonic acid. These acids may attack engine components. There does seem to be a relationship between the amount of water vapor in the fuel and the amount of sulfur, halides and (some species of) siloxanes that enter the engine through the fuel. Lower amounts of water vapor in the fuel have proven to be better.

Silicon crystals. Microscopic silicon (sand) crystals can travel with the landfill gas, agglomerate during combustion, and form larger particles that cling to exhaust valve faces and seats.

Siloxanes. These substances, commonly found in household products like shampoo, cosmetics and detergents, break down during combustion and lead to hard silica (SiO_2) and silicate deposits in combustion chambers, exhaust manifolds and exhaust stacks. In the cylinders, deposits on valve faces lead to grinding action and increased valve seat wear.

Chipping of the silicate deposits accumulated in the combustion chamber can lead to severe valve damage. This occurs when a thick deposit chips away, leaving a gap through which hot combustion gas flows while the valve is closed. It can also occur when a loose chip from the combustion chamber gets trapped in a closing valve as it exits the cylinder. The resulting blowtorch effect melts part of the valve, a phenomenon commonly referred to as guttering.

In many cases where siloxanes are present in the fuel, siloxane buildup on cylinder heads and pistons physically reduces cylinder volume and increases the compression

		Standard Engine	Low Energy Fuel Engine
Sulfur Compounds as H_2S See footnote (1,2)*	mg H_2S/MJ ug H_2S/Btu	0.43 0.45	57 60
Halide Compounds as Cl See footnote (1,3)*	mg Cl/MJ ug Cl/Btu	0 0	19 20
Ammonia	mg NH_3 /MJ ug NH_3/Btu	0 0	2.81 2.96
Oil Content	mg/MJ ug/Btu	1.19 1.25	1.19 1.25
Particulates in Fuel See footnote (1,4)*	mg/MJ ug/Btu	0.80 0.84	0.80 0.84
Particulate Size in Fuel:	microns	1	1
Silicon in Fuel See footnote (1,4)*	mg Si/MJ ug Si/Btu	0.1 0.1	0.56 0.60
Maximum Temperature	°C °F	60 140	60 140
Minimum Temperature	°C °F	-10 -50	-10 -50
Fuel Pressure Fluctuation	kPa ± psig ±	1.7 0.25	1.7 0.25
Water Content		Saturated fuel or air is acceptable. Water condensation in the fuel lines or engine is *not* acceptable. It is recommended to limit the relative humidity to 80% at the minimum fuel operating temperature.	

Table 1. Comparative Fuel Purity Specifications*

** This chart is for purposes of illustration only. Fuel specifications may vary by engine manufacturer and/or engine model. For any specific landfill gas-to-energy installation, the chosen manufacturer's fuel specifications should be consulted.*

ratio, driving up cylinder pressures and carbon monoxide (CO) emissions.

Impact of Fuel Contaminants

The effects of contaminants on the engine depend on a number of factors, including engine component metallurgy, exposure time and rate, engine operating temperature and the brake mean effective pressure (BMEP) of the engine.

With minimal or no fuel treatment, a standard natural gas engine operating on a typical landfill gas can suffer shortened cylinder head life by 50 to 75 percent or more when compared with a similar engine operating on pipeline natural gas. Lube oil life is shortened as well, through acidification and high levels of silicone in the oil from blowby of H_2S and silicon into the crankcase.

Most successful landfill operators analyze their oil for silicon in addition to acids and other standard wear indicators of oil condition. In fact, silicon may dictate the oil change interval: most landfill sites use 100 to 120 ppm silicon in the oil as a condemning limit. Spark plugs in landfill engines also require extra attention, mainly because of silicon deposits, which shield the electrodes and increase the voltage required to fire the plug. A higher level of siloxanes in the fuel typically translates into shorter spark plug life. In extreme cases, plug life can be reduced by as much as 90 percent.

Because each landfill fuel is different and subject to seasonal (and even daily change), operators must customize maintenance programs—intervals for oil and filter changes; spark plug cleaning and replacement; top-end, in-frame and major overhaul; and other tasks. This is best accomplished by collecting site maintenance and operating data, observing wear and degradation trends, and adjusting practices accordingly.

Generator set manufacturers will provide fuel quality specifications that include recommended maximum levels of contaminants allowable in an engine to maintain optimum operating conditions. Fuel exceeding specified contaminant concentration recommendations would compromise performance and/or service life.

Exceeding the maximum contaminant values by a slight amount might simply reduce oil change or spark plug replacement intervals by some small amount. Accepting contaminant levels far in excess of the recommended levels might decrease oil change and spark plug maintenance intervals by quite a bit, and also significantly decrease the time to major service intervals like top-end or in-frame overhauls. And not all contaminants have the same effect on an engine life. For example, if only H_2S greatly exceeds the recommended value, it might only have a major impact on the oil change interval, and not much of an effect on spark plug or overhaul life, while a very high level of siloxanes might lead to decreased oil, spark plug and overhaul schedules.

Not surprisingly, contaminant limits for landfill engines differ from those for standard engines (refer to **Table 1**). The recommended levels of contaminants in the chart are those that will allow the engine to achieve the designed service life represented in the manufacturers' recommended maintenance schedule. Still, these recommended contaminant limits could help remove some trial-and-error from the development of proper maintenance pro-

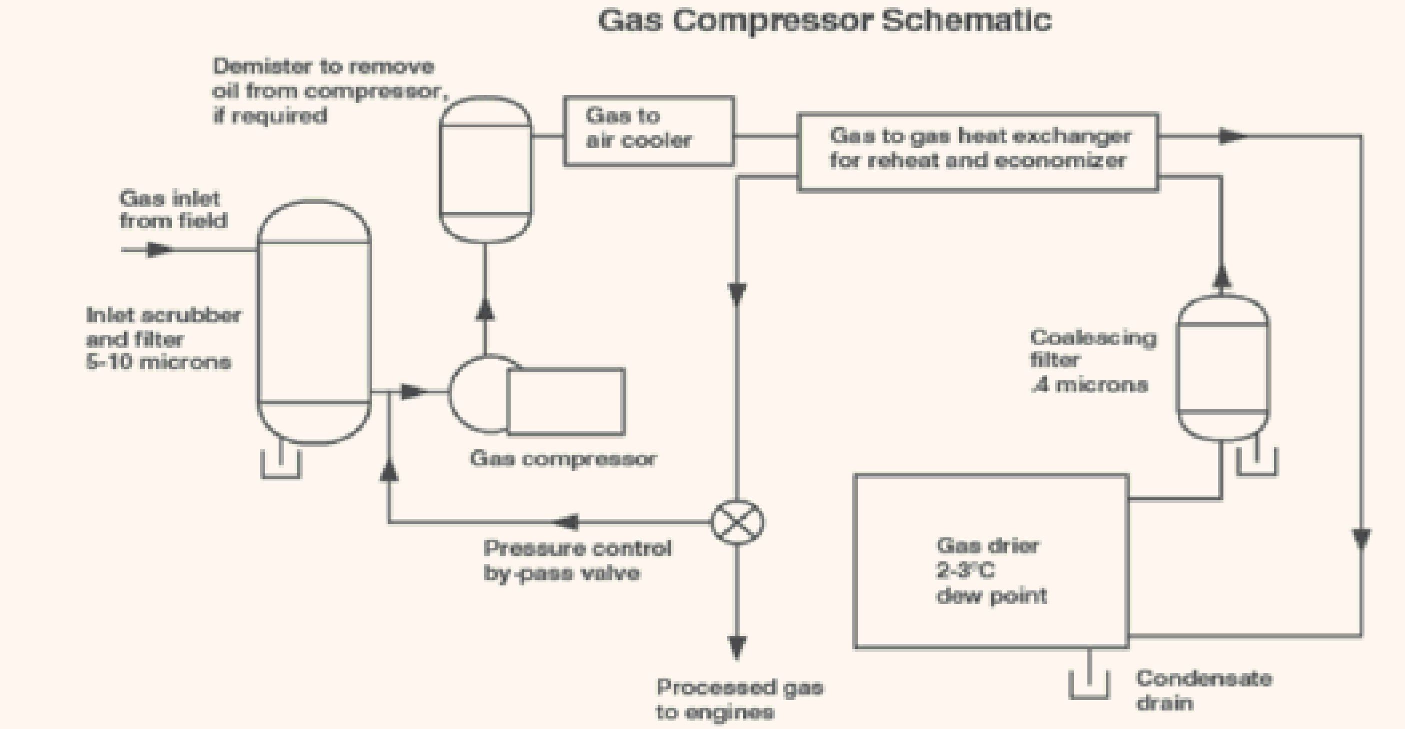
Gas Compressor Schematic
Demister to remove oil from compressor, if required
Gas to air cooler
Gas to gas heat exchanger for reheat and economizer
Gas inlet from field
Inlet scrubber and filter 5-10 microns
Coalescing filter .4 microns
Gas compressor
Pressure control by-pass valve
Gas drier 2-3°C dew point
Processed gas to engines
Condensate drain

Figure 1. Landfill gas-to-energy – Typical Fuel Pretreatment System

grams and fuel delivery systems.

The chart lists maximum recommended fuel contaminants on a "contaminant mass/fuel heat value" basis rather than on a "contaminant mass/volume" basis. Assuming the same level of contaminant per unit volume of gas, a volume at 600 btu/ft^3 (22.4MJ/Nm^3) will have 50 percent of the contaminants of a volume at 300 btu/ft^3 (11.2MJ/Nm^3). When the contaminants are found in concentrations above the manufacturers' recommended levels, higher contaminant levels per unit volume will have a significant impact on the service life of the engine.

As acids naturally form in the engine, it is important to use a type of lube oil that will "capture" these acids. The total base number (TBN) is an indicator of the acid absorbing capability of an oil: the higher the TBN number, the better the acid neutralizing capability.

But higher TBN is not always better for a gas engine. An ash material is typically the oil additive used to neutralize acids, and high ash oils are not recommended for natural gas engines. High levels of ash in lube oil will leave carbon deposits when combusted in natural gas engines that can cause premature wear and require an in-frame overhaul to replace the affected components. Therefore, users should look for an oil with the highest TBN recommended by the engine manufacturer, and use a scheduled oil sampling system to optimize the oil change interval.

Protecting Engines

In protecting engine performance and longevity, there is no free lunch. Either basic approach—fuel pretreatment or the acceptance of reduced maintenance intervals with specially designed landfill engines—adds capital cost and affects long-term maintenance expense. The question is which option is the more economical for a given site.

Fuel pretreatment

A front-end gas processing (pretreatment) system can make up a significant share of a project's capital cost. The components must be chosen for function, reliability and resistance to corrosive damage from the impurities they remove. In theory, pretreatment could deliver near pipeline-quality gas, but that is seldom if ever economical. The pretreatment design usually requires a compromise: fuel good enough to enable reliable engine performance under a reasonable maintenance regimen.

Figure 1 shows a typical gas pretreatment system. Every installation should include an inlet scrubber and fuel filter to remove water droplets from the gas and trap solid matter, and a gas compressor to deliver fuel to the engines at the necessary volume and pressure. Other gas treatment steps commonly include:

Demister: Removes oil from the gas stream in systems where oil is injected into the gas to lubricate the compressor.

Gas-to-air cooler: Lowers the temperature of the gas after it is compressed, thus reducing moisture and preventing condensation and attendant acid formation later in the fuel delivery system, or inside the engines.

Gas-to-gas heat exchanger: Precools the gas entering the drier to reduce drier power demand. The gas leaving the drier is reheated later in the process by the gas-to-gas heat exchanger to prevent water from condensing downstream. These heat exchangers are typically made of stainless steel.

Gas Drier: An effective way to reduce halogens and H_2S in the gas. The device is usually a gas-to-liquid heat exchanger that uses a refrigerant. The gas is dried by chilling to a dew point of 36° to 37°F (2° to 3°C). Because halogens and H_2S are water soluble, reducing water content also

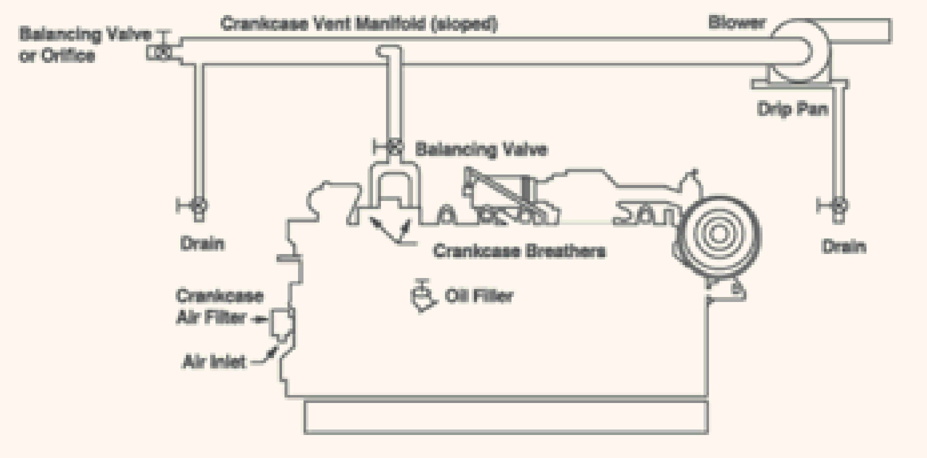

Figure 2. Crankcase Ventilation System

reduces their concentrations. The drier also reduces, to a lesser extent, some species of gas-borne siloxanes.

Coalescing filter: Removes any remaining water or oil droplets, and remaining solid matter down to 0.4 microns in size.

Condensate drain: Collects water removed from the gas. The water may be treated for discharge to a sewer system or, in some locations, reintroduced to the landfill to stimulate methane production.

An effective fuel pretreatment system helps reduce special maintenance demands on the engines but does require maintenance of its own. Every component in the treatment train needs service at intervals dictated by the characteristics of the fuel and the equipment make and model. Since the gas recovery project is only as reliable as the weakest link, all fuel pretreatment components need to be selected with the same attention to detail as the gas compressor, generator set or other system component.

Special engine design

In the mid-1980s, engine designers began looking at the demands of low-energy fuel applications (chiefly landfill and digester gas) and seeking ways to "harden" engines against fuel impurities. In essence, the engine designers accepted the realities of the corrosive fuels introduced to their engines, and modified the design of critical components and systems to counteract the effects of many of these contaminants.

The resulting low-energy fuel engines still require an inlet gas scrubber and gas compressor, and they may need other fuel treatment steps under certain fuel conditions. In general, though, the engine modifications themselves were designed to counteract the effects of fuel-borne contaminants.

While modifications add to the capital cost of the engines, the capital and maintenance cost of pretreatment equipment can be reduced, sometimes significantly. Field experience demonstrates that the engines achieve acceptable maintenance and service intervals, and availability percentages that are highly competitive in the landfill industry. The engine modifications have three basic strategies:

- Keep harmful substances from forming inside the engine.
- Make highly susceptible components corrosion-resistant.
- Eject potentially corrosive gases.

Here are the specific modifications:

Optimized jacket water temperature. A two-circuit cooling system keeps the jacket water at 230˚F (110˚C), optimal for landfill service and well above the 194˚ to 210˚F (90˚ to 99˚C) range typical of standard natural gas engines.

The warmer jacket water temperature inhibits water vapor entrained in the exhaust gas and blow-by gases from condensing on the cylinder liners and on other internal engine surfaces, thus limiting the formation of acids and attendant corrosion. It also helps keep condensation and acid formation from reaching the lubricating oil, further protecting components and helping to extend oil change intervals.

Tests to date indicate that the elevated jacket water temperature can improve oil life, significantly reduce cylinder liner pitting and the corrosion of other cylinder components, crankshafts, bearings and other critical wear parts without jeopardizing expected component life and maintenance intervals.

The elevated jacket water temperature is enabled by a higher coolant flow through the cylinder block, and by the addition of a heat-resistant jacket water system and pump seals. Furthermore, the oil cooler is moved from the jacket water circuit to a lower temperature auxiliary circuit. This keeps the oil temperature from exceeding its allowable limit of 210°F (99°C). The oil cooler thermostat begins to open at 200°F (93°C) to prevent the oil from being overcooled.

Corrosion-resistant materials. As further protection against naturally forming acids, the landfill specific design minimizes the use of bright metals (copper and unprotected steel) in components likely to come in contact with the fuel or exhaust gases. For example, the aftercooler cores, made of copper alloys in standard gas engines, are made of stainless steel in the landfill versions to resist attacks from acids of sulfur, chlorine and fluorine.

On precombustion-chambered engines, the ignition body that holds the prechamber into the cylinder head has higher corrosion resistance than in standard engines. Extensive field testing has shown this component to be susceptible to corrosion unless the material is upgraded.

The balance of landfill cylinder head components are of a similar design as in standard engines, but materials may have been modified for longer life. The intake and exhaust valve materials, for example, have been modified for improved heat resistance, and the valve seat angles are optimized to minimize the formation of hard deposits. On some engines, a three-angle shaped valve face design combines long life with increased contact forces that combat deposits from higher ash oils and other silicon deposits typical in landfill engines.

Crankcase ventilation. An additional line of defense against engine corrosion comes from a low-pressure air pump that draws warm, filtered air into the crankcase and evacuates harmful gases (see **Figure 2**). Thus, when the engine is needed on line or has been shut down for maintenance or repair, the crankcase components are not exposed to condensing corrosive blow-by gases. Engine oil life will be improved as well.

Where ambient air is cool enough so that ventilation air itself might cause condensation in the crankcase, the inlet air can be preheated by passing it through a duct over the exhaust manifold.

Continued on page 31

Application for Membership

ELECTRICAL GENERATING SYSTEMS ASSOCIATION

1650 South Dixie Highway, Suite 500, Boca Raton, FL 33432 • (561) 750-5575 • FAX (561) 395-8557
E-Mail: *e-mail@egsa.org* • World Wide Web: *www.egsa.org*

EGSA's mission is to bring together representatives of the various segments of the On-Site Power Industry, to learn, share ideas and experiences, advance the science of On-Site Power generation, improve performance and profitability of members, and the quality of service to power users.

1. Contact Information

Please type or print all information in upper and lower case (NOT ALL CAPS!)

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Why are you joining EGSA? ☐ Certification Program ☐ CEU Program ☐ Power Schools ☐ Buyers Guide Listing ☐ Other ____________________

2. Member Classification

Read the Membership classifications below and check the box that describes your firm's classification.

I. FULL MEMBERSHIP

☐ MF **Manufacturer Membership**
Any individual, sole proprietor, partnership or corporation seeking membership must apply for a Full Membership as a manufacturer if they meet one or more of the following criteria:

1. They manufacture prime movers for power generation.
2. They manufacture generators or other power conversion devices producing electricity.
3. They manufacture switchgear or electrical control devices.
4. They manufacture or assemble generator sets, UPS systems, solar power, hydropower, geothermal, or any other power production or conversion system including related components or accessories for national or regional distribution.
5. They are a wholly owned subsidiary of a firm which qualifies under rule one through four.

☐ DD **Distributor/Dealer Membership**
Any individual, sole proprietor, partnership or corporation actively engaged as a distributor or dealer for products listed under Manufacturer Membership may apply for Full Membership as a Distributor/Dealer. If an organization qualifies under Manufacturer Membership, it is not qualified under this section.

☐ MR **Manufacturer's Representative Membership**
Any individual, sole proprietor, partnership or corporation actively engaged in the representation of products listed under Manufacturer Membership may apply for Full Membership as a Manufacturer's Representative. If an organization qualifies under Manufacturer Membership, it is not qualified under this section.

☐ EM **Energy Management Company Membership**
Any individual, sole proprietor, partnership or corporation engaged in energy management, including Energy Service Companies (ESCOs), Independent Power Producers (IPPs), Integrators, Aggregators, and other similar enterprises may apply for Full Membership as an Energy Management Company.

☐ **Associate Full Membership** (mark appropriate category at right)]
Any individual, sole proprietor, academic institution, student, partnership or corporation meeting the requirements of Associate Regular Membership may apply for Full Membership at their option to enjoy the privileges of Full Membership, including the rights to vote and to serve on EGSA's Board of Directors. Initiation fees and annual dues will be assessed at the existing non-manufacturers' Full Member rates.

II. ASSOCIATE REGULAR MEMBERSHIP

☐ AA **Trade Publication Membership**
Any trade publication dealing with the electrical generating systems industry or its suppliers may apply for Associate Membership—Trade Publications.

☐ AB **Trade Association Membership**
Any trade association made up of individual or company members sharing a common interest in the electrical generating systems industry may apply for Associate Membership—Allied Associations.

☐ AC **Engineer Membership**
Any consulting or specifying engineer may apply for Associate Membership—Engineer. Membership may either be held in the employer's name or individual's name under this classification. Individuals whose employer qualify as a Full Member, as described in the Full Membership section, do not qualify for this category.

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Any individual employee of a company who owns or operates electrical generating equipment and/or related switchgear or components, whose responsibility to his employer includes planning, design, installation, supervision, or service of such equipment may apply for Associate Membership—User. Membership may either be held in the employer's name or individual's name under this classification. Individuals whose employer qualify as a Full Member, as described in the Full Membership section, do not qualify for this category.

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Any individual, organization or academic institution that offers services such as research, testing or repair to the electrical generating systems industry may apply for Associate Membership—Services. Membership may either be held in the individual's name or the organization's name under this classification. Individual companies whose employer or parent organization qualifies as a Full Member, as described in the Full Membership section, do not qualify for this category.

☐ AG **Educational Institution Membership**
Any postsecondary vocational-technical school or college offering on-site power generation-related instruction may apply for Associate Membership-Education Institution.

☐ AR **Retiree Membership**
Any individual who retires from a member company may apply for Associate Membership—Retired. This classification does not apply to any individual who is employed more than 20 hours per week.

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Any individual currently enrolled at an academic institution may apply for Associate Membership—Student.

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Mentor AssignedCommittee Interest

Application for Membership – page 2

Dues Schedule (Use for Section 3)

	Annual Dues	Initiation Fee	TOTAL
Manufacturer	$825	$200	$1025
Energy Management Companies	$825	$200	$1025
Distributor/Dealer	$285	$100	$385
Manufacturer's Rep	$285	$100	$385
Regular Associate Member	$200	$100	$300
Full Associate Member	$285	$100	$385
Retiree Member	$90	$0	$90
Student Member	*Complimentary*	$0	$0

NOTE: A FULL 12-MONTH DUES PAYMENT MUST BE RECEIVED WITH THIS APPLICATION. The Association's Membership Year is January 1 through December 31. Dues payments that extend beyond the first Membership Year will be applied to the second year's dues.

FULL PAYMENT MUST BE RECEIVED WITH APPLICATION.

3. Membership Dues (Please fill in the appropriate TOTAL amount from the above dues schedule.)

Membership Dues $__________

Membership Plaque (optional)** $ 39.95**

On-Site Power Reference Book (optional)** $ 125.00**

Florida Residents: Add 6.5% Sales Tax to ** items $__________

*Continental US Residents add $5 shipping/handing to**items.* $__________

*Non Continental US Residents should call EGSA Headquarters for shipping charges for **items.*

TOTAL $__________

4. Payment Method (Payable in US$ drawn on U.S. bank, U.S. Money Order, or American Express)

☐ Check #____________ Amount $ __________

☐ Money Order

☐ Mastercard ☐ Visa ☐ American Express

Card # __________________________ Exp. Date ______

Signature: ____________________________________

Print Name: ___________________________________

5. Products/Services

Please describe the nature of your business (50 words or less, NOT ALL CAPS) If you are a Manufacturer's Representative or Distributor, please indicate which manufacturers you represent and/or distribute for:

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Available Codes:

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02 ---Control/Annunciator Systems
04 ---Enclosures, Generator Set
05 ---Engines, Diesel or Gas
06 ---Engines, Gas Turbine
07 ---Engine Starters/Starting Aids
08 ---Filters, Lube Oil, Fuel or Air
28 ---Fuel Cells
03 ---Fuel Tanks and Fuel Storage Systems
09 ---Generator Laminations
10 ---Generator Sets
11 ---Generators/Alternators
12 ---Governors
13 ---Heat Recovery Systems
14 ---Instruments and controls, including meters, gauges, relays, contactors, or switches
15 ---Load Banks
16 ---Motor Generator Sets
17 ---Radiator/Heat Exchangers
18 ---Relays, Protective or Synchronizing
19 ---Silencers/Exhaust Systems/Noise Abatement
20 ---Solenoids
21 ---Swtichgear and Transfer Switches (Automatic or Manual), Bypass Isolation Switches, and/or Switchgear Panels
22 ---Trailers, Generator Set
23 ---Transformers
24 ---Uninterruptible Power Supplies
25 ---Vibration Isolators
26 ---Voltage Regulators
27 ---Wiring Devices or Receptacles

Enter codes here:

Products sold: ______________

____

Products rented: ______________

____

Products serviced: ______________

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Do you buy AND sell equipment? ☐ Yes ☐ No Do you manufacture packaged equipment? ☐ Yes ☐ No

6. Sponsor(s)

: A"Sponsor" is an EGSA Member who interested you in filling out this application. It is not mandatory that you have a sponsor for the Board to act favorably on this application; however, if a Member recommended that you consider membership, we request that individual's name and company name for our records.

Sponsor Name ______________________________ Company Name ______________________________

7. Official Representative's Authorization

Signature ____ Date ____________________

Continued from page 28

Comparing Options

Comparing the merits of external fuel pretreatment with the merits of engines designed for landfill service requires a rigorous but relatively simple cost analysis.

The process begins with a fuel analysis, because that largely dictates the degree of fuel pretreatment that landfill engines will need. If the landfill has been in operation for awhile, multiple samples should be evaluated to understand the minimum and maximum methane content, as well as the minimum and maximum contaminant levels expected in the fuel over time. If the landfill is a new installation, a landfill sample with an "educated guess" as to the methane content and expected fuel contaminant levels (based on the expected fill materials) should be evaluated. In general, the more contaminants there are in the fuel, and the larger their concentration, the greater the demands on the pretreatment system, and the greater its cost.

From experience, the pretreatment system designer can estimate the capital (installed) cost of the system, in addition to the expected maintenance cost of the components and the projected total ownership cost.

Based on the expected quality of the treated fuel, the generator set manufacturer will be able to project intervals for basic maintenance, as well as expected run times to top-end, in-frame and major overhauls. This will enable a calculation of the total costs of maintenance, which will include the service labor, components and consumables (fluids, filters, etc.) costs over the project life.

Manufacturers with experience in landfill operation may be able to provide long-term maintenance contracts that guarantee a fixed maintenance cost per kilowatt hour. Such contracts also can include guarantees covering uptime (as a percentage of total available operating hours) and emissions levels.

With these calculations complete, it is relatively simple to compare installed and ownership costs per kWh for the two alternatives. As a general rule—and especially where the cost difference is not compelling—it may be worthwhile to consider various intangibles. These include:

- Familiarity of in-house staff with the equipment they will be asked to maintain.
- The quality and availability of service and technical support (including time to deliver routine and emergency replacement parts).
- The comparative track records of the equipment suppliers (in particular, their direct experience in landfill gas-to-energy projects).

Cases in Point

Elevated jacket water temperature technology has been in use in landfill applications since the mid-1980s, and many of the other landfill modifications have evolved since then. Altogether, these technologies (using Caterpillar® engines alone) are at work on more than 920 MW of landfill gas projects installed since 1996.

The modifications are available on landfill versions of advanced gas engines developed through the U.S. Department of Energy Advanced Reciprocating Engine Systems (ARES) program and introduced commercially starting in late 2002.

These ARES landfill gas engines will be available in 12-, 16- and 20-cylinder configurations, operating at 50 Hz or 60 Hz, at speeds up to 1,500 rpm, with ratings up to 1,950 kW. A leaner fuel mix reduces combustion temperatures and drives down NO$_x$ formation. NO$_x$ ratings as low as 1.0 and 0.5 g/bhp-hr, 60 Hz (250 and 500 mg/Nm^3, 50 Hz) are available without exhaust aftertreatment. A low-pressure fuel system (1.5 to 5 psi/10 to 35 kPa) makes the units adaptable to landfill gas service.

Here are a few examples of landfill gas-to-energy projects driven by engines designed to tolerate landfill gases:

Seneca Meadows Landfill, Seneca Falls, NY. This energy system, owned by Innovative Energy Systems of Oakfield, NY, began operating in 1996 and has been expanded three times to its current 11.2 MW capacity.

The system uses 14 Cat® G3516 generator sets modified for landfill service. As of 2004, the first three generator sets had run times of 68,000 hours, and management

Continued on page 36

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It's no secret that technology is becoming more complex—not less—and that makes today's On-Site Power Generation System a lot more expensive. End-users—your customers—don't want just anybody with a basic knowledge of mechanics to install and maintain their equipment. They want to be confident that all work has been performed by qualified personnel. Suppliers want assurance that skilled technicians are performing maintenance and repairs to guard against unnecessary returns or warranty repairs.

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EGSA offers you a big advantage: For the first time in our industry, we have an objective and accurate way to determine generator technician proficiency. That means that the same standards will be used to measure the skills and knowledge of technicians from Maine to Manitoba and Mexico. Yes, Manitoba and Mexico! EGSA has determined that there is no reason why the test could not be fairly applied to any NAFTA technician.

What are the Benefits?

For the Employer, certification helps ensure that your technicians have the critical knowledge and skills to succeed in their jobs. And everyone will be comfortable knowing that your certified techicians' expertise has been confirmed by *the* industry organization through a program that was developed by a university. Encouraging and helping your technicians become certified signifies your commitment to the highest of standards. Plus, it lends an added level of credibility to your firm and can sharpen your competitive edge. Employing certified techs will promote customer satisfaction and you won't have to be shy about offering assurance that your techs are qualified. Certification can also help you select potential new hires, analyze job performance, evaluate employees and motivate technicians to enhance their skills and knowledge.

Think about the message that certification sends to those with whom you do business. Why would anyone want a technician who isn't certified performing critical maintenance or repair tasks? Employing certified technicians gives you an added tool with which to market your business.

As our members have said, "We've seen too many backyard mechanics damage expensive equipment. This program will provide credibility for my company and will help build pride and a commitment from technicians to be the best."

For the Technician

Certificate holders benefit too. Certification shows employers, clients, and associates that you are committed as a professional. It provides recognition of your knowledge and skill, shows your commitment to your profession and can help with job advancement. Certification is a mark of excellence that you carry with you everywhere you go.

Acquiring certification indicates that you have the knowledge and proficiency required to perform as an Electrical Generating Systems Technician professional. Becoming certified can increase your salary, enhance your skills, and make your job more satisfying.

Certification helps ensure that your technicians have the critical knowledge and skills to succeed in their jobs.

The Certification Test

EGSA collaborated with Ferris State University to develop the certification test and program. Through a scientific process, our panel of technical experts identified 12 duty areas (such as "Basic Electricity") and 61 tasks (such as "demonstrate knowledge of AC electrical theory") within the duty areas. The duty areas and tasks were ranked and rated in terms of their relative importance, the frequency with which a task is performed, and skill level (i.e. Senior/Expert; Intermediate; and Entry Level.) All this data was combined to develop the certification test that was then statistically validated through a pilot test taken by generator technicians from across the United States.

Who can take the Test?

There are no pre-qualifications for taking the EGSA Certification test. We recommend three or four years of field experience before taking the test. Technicians who have had formal education in On-Site Power Generation (a degree or certificate from a technical school or community college) may need less field experience. Those who pass the test will have a comprehensive knowledge of basic electricity, the functions of a gen-set's mechanical and electrical components, the interactions and relationships among components and an understanding of various elements of the installation, service, maintenance, and repair of gensets and On-Site Power Generation Systems.

CERTIFICATION TESTING COVERS:

- *Automatic Transfer Switches*
- *Communication & Documentation*
- *Engine Generator Instrumentation & Controls*
- *Multiple Generator Switchgear & Controls*
- *Troubleshooting System Problems*
- *Auxiliary Support Systems*
- *Basic Electricity*
- *Prime Movers*
- *Governors*
- *Voltage Regulators*
- *Generators/Alternators*

Use the Study Guide to Prepare!

Use of the program's Study Guide is an excellent way to help techs prepare for the test and should clearly indicate if they are ready to take (and pass) the certification exam. In addition to useful formula pages, the guide contains almost 200 multiple choice practice questions that cover all parts of the certification test. In addition to identifying the correct answer, the guide also indicates in most cases why a particular choice is correct and why the others are incorrect. The Guide also identifies resource material where techs can get additional or more in-depth information about a given topic.

Need more information? Visit *www.egsa.org* to find extensive and detailed information about the certification program. Or contact EGSA Director of Education George Rowley via e-mail at *g.rowley@egsa.org*.

DISCLAIMER OF LIABILITY

Certified status is an indication that an individual has completed a combination of defined education, experience or examination requirements. However, Certification is not a guarantee or assurance of the competence or ability of any particular individual. Further, given the rapid changes in the field, the Electrical Generating Systems Association cannot warrant that the Examination and other Certification materials will at all times reflect the most current state of the art. The Electrical Generating Systems Association disclaims liability for any personal injury, property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the Certification Program or the acts or omissions of any person who has been Certified by the Electrical Generating Systems Association. In conducting the Certification Program, including issuing Certifications, the Electrical Generating Systems Association is not undertaking to render professional or other services for or on behalf of any person or entity, nor is the Electrical Generating Systems Association undertaking to perform any duty owed by any person or entity to someone else. Anyone using the services of a person who has been Certified should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

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EMERGENCY POWER SYSTEM SPECIALISTS

Generator Technician—Experienced

Emergency Systems Service Company in Quakertown, PA, a leading provider of emergency generator sets, has an immediate opening for a technician with a minimum of three years diesel engine/generator set background/experience. Responsibilities will involve troubleshooting, repair and the planned maintenance services of generator sets and peripheral equipment. A neat appearance, clean driving record and good people skills are required. We offer a highly attractive compensation with an outstanding benefits package. A company vehicle and additional training provided. If you are interested in becoming part of our team, please call **(215) 536-4973, ext. 25.**

Generator Technician–Apprentice

Emergency Systems Service Company in Quakertown, PA, a leading provider of emergency generator sets, has an immediate opening for a person with a strong mechanical/electrical background interested in a career in the power generation service field. Responsibilities will involve minor troubleshooting, repair and the planned maintenance services of generator sets and peripheral equipment. A neat appearance, clean driving record and good people skills are required. An outstanding benefits package, company vehicle and additional training provided. If you are interested in becoming part of our team, please call **(215) 536-4973, ext. 25.**

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Individual with over 20 years of significant sales/management experience in the engine and power generation industry. Proven marketing and sales management skills with a track record of growth and profitability improvement.

Extensive and diverse power systems market segment experience, including: Petroleum, Marine, Agricultural, Mining, Governmental, OEM, Distributed Generation, CHP, and Foreign Governments.

Excellent understanding of the used and surplus markets. College degree, excellent interpersonal skills, participative management style, and strong, customer-led attitude. Ability to quickly make sound decisions. Willing to relocate. Please send reply via e-mail to *J.Kellough@EGSA.org*.

Inside Sales Coordinator/Engineer

3-D Service (*www.3-dservice.com*), a growing industrial service company, is accepting resumes for, Inside Sales Coordinator/Engineer in our Generator Division to be responsible for inside sales, coordination of field service assignments and customer communications. This individual will be responding to sales calls, processing customer orders, providing technical support to customers and field personnel as well as customer support. Possessing the abilities to develop new leads, promote/increase the customer base and project management is a plus. Some travel & evenings/weekends may be required. Competitive salary and benefits. Send resume and salary requirements to: *resume@3-dservice.com*. No phone calls please. Please visit our web site at *www.3-dservice.com*.

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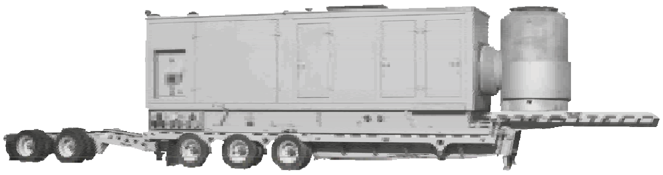

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Continued from page 31

had projected that they could run 100,000 hours before major overhaul. In the fuel pretreatment system, methane at 3 psi passes through a chiller and into a glycol bath that removes halides, moisture and particulates down to 0.1 micron. Overall energy plant NOx emissions are 1.3 g/bhp-hr, compliant with local air quality standards.

Rhode Island Solid Waste Landfill, Johnston, RI. Ridgewood Renewable Power in July 2005 commissioned four Cat G3520C Low Energy generator sets, among the first such units shipped in North America. Each of these units is driven by an ARES-derivative 20-cylinder engine delivering 1.6 MW.

The system was installed by Milton Cat in Milford, MA, which shared the operating risk by offering a performance guarantee and a fixed maintenance price per kWh under a comprehensive maintenance program. Emissions compliance is also guaranteed under the contract (the units are rated at 0.5 g/bhp-hr NO_x).

South East New Territories Landfill, Hong Kong. This site, operated by Green Valley Landfill Ltd., installed two Cat G3516 landfill generator sets in 1997. Each unit is rated at 970 kW, providing 1.9 MW of continuous power for the landfill infrastructure and an on-site wastewater treatment plant. The units operate in parallel with the local utility, exporting excess power to the grid. The generator sets have oversized radiators to compensate for tropical heat and humidity.

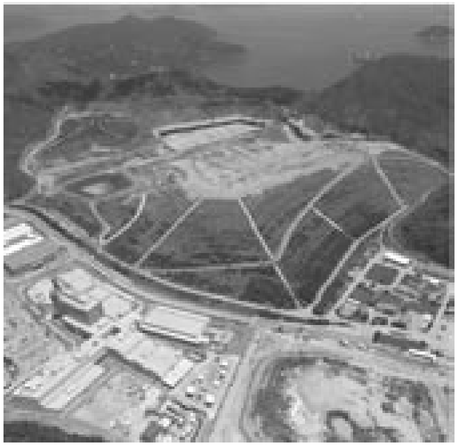
Management reports that the facility is online 99 percent of the time. Green Valley Landfill provides regular maintenance in-house while top-end, in-frame and major overhauls are performed by The China Engineers, the local Cat dealer.

Seneca Meadows Landfill.

Conclusion

Landfill gas-to-energy system operators have a range of options for dealing with fuel-borne contaminants. Both fuel pretreatment systems and special engine designs that combat the effects of corrosive fuels have proven effective in multiple applications worldwide.

Because the relative costs and benefits of these basic options can vary greatly with site-specific conditions, operators should analyze both methods of fuel contaminant control as part of project planning. The "right answer" for any one project may well include a combination of fuel pretreatment options and optimized engine maintenance practices. To forego this analysis is to risk missing an opportunity to achieve the lowest practical capital and maintenance cost for the system.



South East New Territories Landfill.

About the Author

Michael A. Devine is Gas Product/Marketing Manager for the Electric Power Group of Caterpillar Inc., based in Mossville, IL. In his 30 years with Caterpillar, Devine has filled a variety of roles, including manufacturing, service engineering, electric power product and project management, and education and training. Involved with power generation since 1979, he has spent most of this time working to develop power generation products to serve the load management, distributed power, quality power and landfill-to-energy markets. He has traveled extensively, working on power projects and educating utility companies and power users worldwide on the benefits of Landfill, Digester, Distributed Generation and Cogeneration applications. ■

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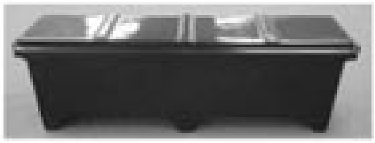

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Kickham Boiler Establishes Vaporphase Division

ST. LOUIS, MO—Kickham Boiler Inc. has announced it has established the Vaporphase Division, Kickham Boiler Inc. The company has fabricated Vaporphase Equipment for over 35 years. Kickham Boiler Inc. also has announced that EGSA President-elect Warner Bauer has joined the firm as Vice-President of the Vaporphase Division. Mr. Bauer brings with him over 45 years of experience in the design and application of Vaporphase products and systems. His background, said a company press release, "complements our long history of supplying quality products… (and) confirms our continued commitment to the industrial and institutional communities." For more information, visit *www.kickhamboiler.com*.

Woodward, Cummins Sign Sourcing Agreement

FORT COLLINS, CO—Woodward Governor Company announced it has signed a three-year sourcing agreement with Cummins Inc. to provide components for diesel and natural gas engines.

"This multi-year sourcing agreement benefits Woodward and Cummins by allowing development of a more efficient supply chain and production coordination," said Chad Preiss, Woodward vice president. Woodward will supply products for controlling air and fuel delivery such as governors, actuators, controllers, fuel shut-off solenoids, and fuel air mixers to Cummins Inc.

"Woodward's core portfolio of energy control products and systems provides Cummins with components that help their engines run more efficiently at high performance with lower emissions and cost," continued Preiss. "The agreement strengthens Woodward's position to build on the current business we have with Cummins."

Cummins Inc. builds heavy-duty engines for on- and off-highway applications; power generating systems and standby

News is continued on page 39

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For complete information on EGSA's On-Site Power Schools—including a schedule and registration materials—and full details on our Continuing Education program, visit us online at *www.EGSA.org*.

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EGSA Electrical Generating Systems Association

Continued from page 37

generators for commercial and consumer use; engine filtration and aftertreatment products; engines for mining, oil and gas, agricultural and marine markets.

Woodward provides energy control solutions for aircraft engines, industrial engines and turbines, and power generation and mobile industrial equipment and is headquartered in Fort Collins, CO. For information, visit www.woodward.com.

Fox Valley Technical College Diesel Program Wins Award

APPLETON, WI—The Fox Valley Technical College (FVTC) Diesel Technology program has earned the 2006 Outstanding National Training Award, sponsored by Cummins Engine Company. Key items recognized by Cummins as distinguishing FVTC's program include the amount of faculty training and experience, the state-of-the-art J.J. Keller Transportation Center and the availability of work experience for students while attending classes. As part of the award, the Diesel Tech program received a $10,000grant toward Cummins service training hardware. For more information visit *www.fvtc.edu.*

Siemens to Build Combined Cycle Power Plant in UK

ERLANGEN, GERMANY—The Siemens Power Generation Group (PG) will build a turnkey combined cycle power plant in the UK. Purchaser is Marchwood Power Ltd., a 50/50 joint venture of ESBI and Scottish & Southern Energy Plc, who will jointly operate the plant on completion, scheduled for summer of 2009. The contract including a long-term service agreement for the power plant is valued at approximately EUR500 million.

Siemens will build the gas-fired combined cycle power plant with a capacity of 840 megawatts (MW) in the vicinity of Southampton on the English south coast. For the turnkey project Siemens PG will supply two SGT5-4000F gas turbines, one SST6-5000 steam turbine and three generators. The scope of supply will also include the entire mechanical equipment with two heat-recovery steam generators, the electrical system, the SPPA-T3000 plant control system as well as a 22-km gas pipeline to connect the plant to the national gas transmission network.

"The Marchwood Power plant will be the eighth turnkey power station constructed by Siemens in the UK," said Klaus Voges, President of Siemens Power Generation. "With a capacity of more than 6000 MW these plants confirm our strong UK power plant presence," added Voges.

Up to 12,000 MW of new generation capacity could be required in the UK by 2012 to meet the growing demand and to compensate plant retirements. Renewables as well as gas-fired combined cycle power plants are integral parts of the UK's aim at reducing CO2 emissions. Siemens recently secured an order for the Whitelee Wind Farm to be located south of Glasgow in Scotland. With an installed capacity of 322 megawatts (MW) it will be Europe's largest wind farm. For more information, visit *www.siemens.com.*

News is continued on page 40

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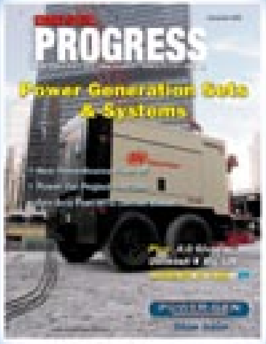

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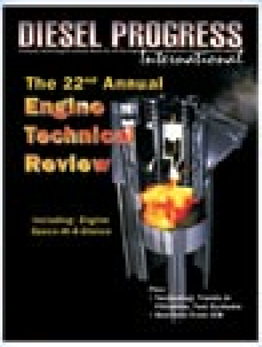

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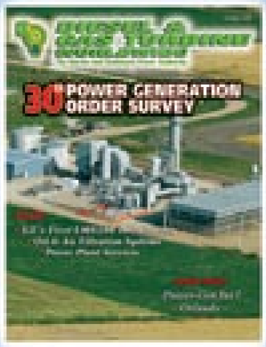

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Continued from page 39

Ecostream Opens First U.S. Office in Sacramento

SACRAMENTO, CA—Netherlands-based Ecostream, a fast-growing renewable energy system integrator, has opened its first American office in Sacramento, CA.

Ecostream is entering the US market in order to play an active role in market developments there together with customers. Steven Pleging, CEO of Ecostream International, states: "The US represents a potentially important market for clean energy investment - a market in which California is currently playing a leadership role. By expanding our business operations to the West Coast of the US we can take full advantage of two decades of renewable energy experience in Europe. There are now better prospects for greater federal commitment to clean energy solutions in the US. In the short term we offer turnkey projects for solar roof installations and in the middle to long term we will aim to meet growing market demand for other renewable energy solutions."

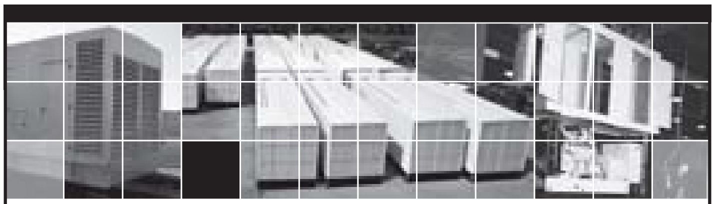
Faried Muscati has been appointed Chief Executive Officer of Ecostream in the US. He has considerable experience in the solar business. The entrepreneur worked for many years as director foreign sales operations at Solarworld, a large German producer of solar modules. Muscati explains the rationale for setting up an office in Sacramento: "This will create up to 15 engineering, financing and management jobs in 2007."

Ecostream is part of the international Econcern group, which has its headquarters in the Netherlands. For more information visit *www.econcern.com.*

Rohrer Named GM for Compliance Controls and Murphy Power Ignition

TULSA, OK– Rick T. Rohrer has been named General Manager for Compliance Controls, LLC and General Manager of Murphy Power Ignition (MPI). Compliance Controls is a joint venture of MIRATECH Corporation and FW Murphy that provides Windows®-based air-to-fuel ratio control systems for rich and lean burn as well as fuel-injected stationary spark-ignited natural gas fueled engines. Murphy Power Ignition is a manufacturer of advanced technology instruments that maximize the power of industrial spark-ignited natural gas-powered engines. Murphy Power Ignition is wholly owned by Murphy.

Rohrer brings extensive executive level domestic and international experience implementing sales, marketing and operational strategies to this newly created position. Rohrer is a past executive vice president for sales and marketing for Engius, LLC – a leader in advanced technology products to the concrete construction industry. Prior to Engius, Rohrer was vice president for customer service and Hilti Center operations for Hilti, a global multi-billion dollar manufacturer of construction fastening equipment. For more information, visit *www.compliancecontrols.com* ■



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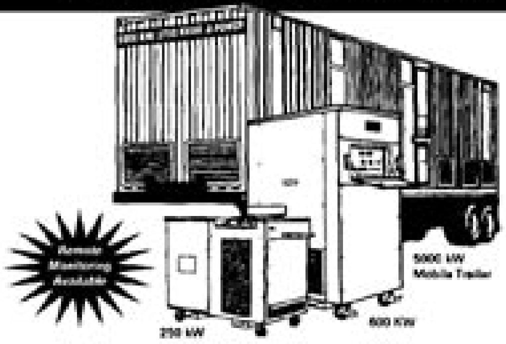

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(905) 765-3038
Contact: Jonathan Barrett
Business: Electrical Power Generation Technician student at Fleming College.

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Business: Electrical Power Generation Technician student at Fleming College.

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Contact: Tyler Bridger
Business: Electrical Power Generation student at Fleming College.

Giulio Careri. . . . . (AF)
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(705) 324-6418
Contact: Giulio Careri
Business: Electrical Power Generation student at Fleming College.

Central Machinery & Electric Ltd.(DD)
New Providence, Bahamas
(242) 322-4260 Fax: (242) 322-4260
Contact: Pedra Darling, General Manager
Business: Sales and service of generators and automatic transfer switches.

Lucky Chhoeun . . . . (AF)
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Contact: Lucky Chhoeun
Business: Electrical Power Generation Technician student at Fleming College.

Collicutt Energy Services Inc. . . (DD)
West Sacramento, CA
(916) 371-1667
Contact: Barry Hinesley, General Manager
Business: Power Generation sales and service.

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Business: Electrical Power Generation Technician student at Fleming College.

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FM Solutions . . . . (AE)
Phoenix, AZ
(602) 824-5367 Fax: (602) 265-9477
Contact: Daniel Rusch-Fischer CFM, LEED-AP, Associate
Business: Architectural design, facility consulting.

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Business: Electrical Power Generation Technician student at Fleming College.

Jerry McDonald . . . . (AF)
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Contact: Jerry McDonald
Business: Economics student studying the development of alternative sources of energy at Triton Community College.

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Business: Electrical Power Generation Technician student at Fleming College.

Greg Morley. . . . . (AF)
Lucan, ON Canada
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Contact: Greg Morley
Business: Electrical Power Generation Technician student at Fleming College.

Michael Muro. . . . . (AF)
DuBoistown, PA
(570) 323-7981
Contact: Michael Muro
Business: Full-time student at Pennsylvania College of Technology dual majoring in Electric Power Generation and Heavy Construction Equipment Technician.

Power Pro-Tech Services, Inc. . . (DD)
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Bradenton, FL
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Contact: Sam Pletcher, Owner
Business: Sales, service, installation dealer of generator systems.

Sir Sandford Fleming College . . (AG)
Lindsay, ON Canada
(705) 324-9144 Fax: (705) 878-9333
Contact: Carmen Moore, Professor
Business: College/EPG Training

Mark Wagner . . . . (AF)
Guelph, ON Canada
(519) 763-9121
Contact: Mark Wagner
Business: Electrical Power Generation Technician student at Fleming College.

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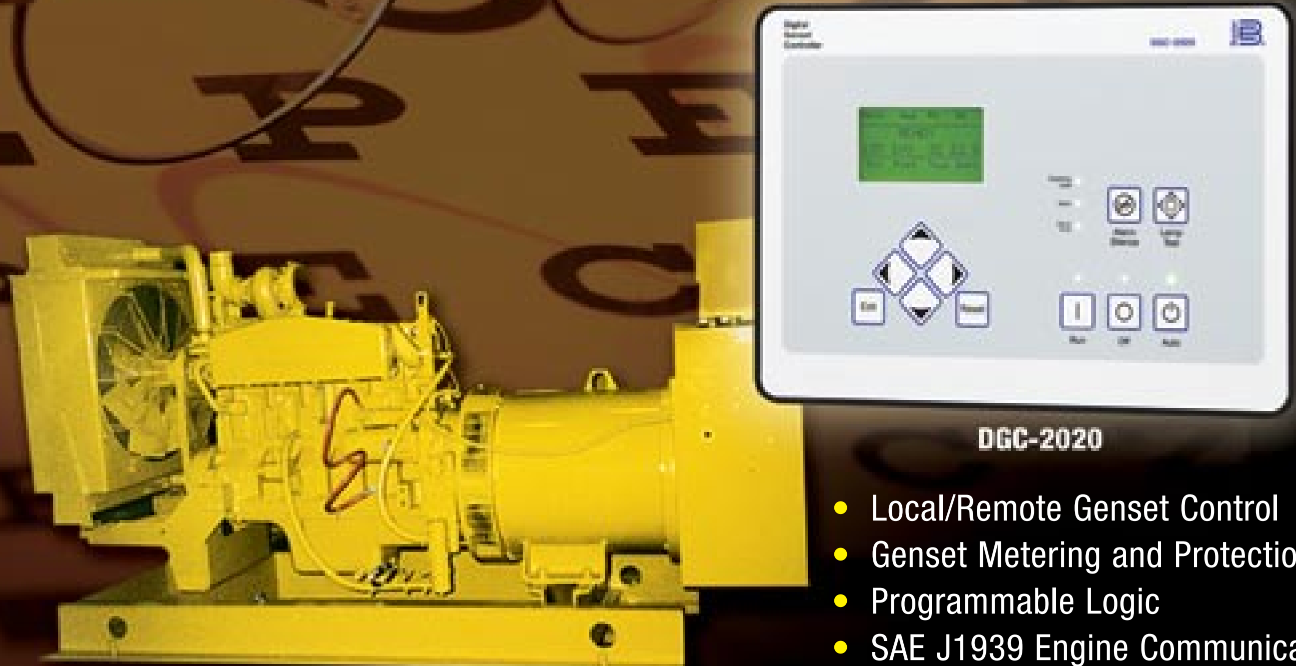

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